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Seminars in Cutaneous Medicine and Surgery

A Multidisciplinary Approach to Evaluation and Treatment of Atopic Dermatitis

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Atopic dermatitis is a common, complex disease that frequently follows a chronic, relapsing course. The disease can impact the quality of life (QOL) of patients and families to a significant degree. Patients and caregivers may focus on unproven triggers at the expense of proper skin care. A multidisciplinary approach is needed to comprehensively evaluate triggers and response to treatment, address confounding factors including sleep disruption, and educate patients and caregivers.
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Atopic dermatitis (AD) is a common, complex disease that frequently follows a chronic, relapsing course and results from as-yet incompletely understood interactions of genes and environment in susceptible individuals.[1,2] Recent insights into AD have pointed to the role of abnormalities in the epidermal barrier, although these abnormalities may be caused by both mutations of genes encoding proteins such as filaggrin,[3] as well as modulation of epidermal protein levels by Th2-type cytokines.[4,5] In addition, patients with AD appear to have abnormalities in their innate immune response[6] and can have abnormal immunologic responses to allergens and microbial antigens.[3,7]

Although patients may have mild disease and appear to outgrow their AD, in some studies, a significant number of patients develop more severe or persistent disease.[8] These patients and their families may experience significant impairment in QOL.[9] Childhood AD may have a greater impact on health-related QOL than asthma, diabetes, enuresis, and cystic fibrosis.[10] In addition, a significant number of patients with AD go on to develop asthma and allergies and this important association is often not explained to patients and caregivers.[11] Finally, AD places a significant economic burden on the patient, family, and society.[12,13] Thus, a multidisciplinary approach is needed to comprehensively evaluate triggers and response to treatment, address confounding factors including sleep disruption, and educate patients and families.

Who Are the Members of the Multidisciplinary Team?

The model described is the Atopic Dermatitis Program (ADP) at National Jewish Medical and Research Center in Denver, Colorado. The ADP has been in existence for more than 20 years, and 3 of the authors have worked together in this program for the past 18 years. Our team is composed of pediatric allergist-immunologists with extensive experience in basic and clinical research in AD, a nurse practitioner/dermatology clinical specialist, pediatric psychiatrist, psychologists, allergy-immunology fellows-in-training, physician assistants, nurse educators, child life specialists, a creative art therapist, social workers, dietitians, and rehabilitation therapists. Dermatologists are available for consultation if the diagnosis of AD is in question or alternative therapies, eg, phototherapy are being considered. Our philosophy of care is in keeping with our Center's approach to individualized medicine, and patients undergo comprehensive evaluation and treatment tailored to their needs and goals of the patient. Our ADP provides single-day consultations in addition to a multiple-day outpatient clinic visits or Day Program for more extensive evaluation, education, and treatment. This unique program allows for comprehensive evaluation and treatment of patients in an outpatient setting, typically over the course of 5 to 10 days. In this controlled environment, patients and caregivers interact with members

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of the multidisciplinary team between 8 AM and 5 PM, as well as overnight, if necessary, especially when evaluating sleep disturbance and response to interventions.[14] Importantly, patients and caregivers interact with other patients and families in formal and informal settings. The ongoing evaluation and response to therapy in the Day Program are reviewed in clinical review meetings with the patient/caregiver and Plan of Care conference that involves input from the various services. Rarely, patients may also be admitted as in-patients.

Who Are the Patients That May Benefit from a Multidisciplinary Approach?

Although AD patients of all severities could benefit from a multidisciplinary approach, the current health care system often creates roadblocks to such an approach. Patients who are "failing" conventional therapy, those labeled as polyallergic (especially those believed to be allergic to multiple foods), patients with recurrent skin infections or who are receiving frequent courses of antibiotics, patients with concerns about medication side-effects, patients whose disease is causing a significant impact on their or their family's QOL, and those patients with a need for in-depth education are all candidates for multidisciplinary management. It is worth remembering that families may have different levels of tolerance for a disease; thus, this approach may benefit more than just severe AD patients.

The patient and family with chronic AD have often seen multiple health care providers who may have given them confusing or conflicting information, which sets up a cycle of frustration and search for a straightforward solution to their problem. Practitioners of unproven therapies may take advantage of these patients, even promising a cure. Thus, it becomes imperative to convey the message that at present, treatment is directed at levels of control, not a cure. The significant and sustained clinical improvement often observed in the patients treated with a multidisciplinary approach may be caused in large part by in-depth, hands-on education, along with changes in environmental exposures, reduction in stressors, and assurance of adherence with therapy. A high percentage of these patients experience significant improvement even when treated with medications that previously were believed to be ineffective when the treatment is integrated into a comprehensive and individualized management program.

Education of Patients and Caregivers

The burden of AD can be improved by targeting parents and caregivers with education, psychosocial support, and specialty care.[9] Education includes teaching about the chronic or relapsing nature of AD, exacerbating factors, and therapeutic options that are important to both patients and caregivers.[15] Such critical education is increasingly difficult to accomplish in the typical clinic visit. Studies have shown that patients fail to receive adequate explanation of the causes of AD or are not taught how to apply topical medications, even though instruction and practical demonstrations may be associated with dramatic improvement in the treatment outcomes.[16]

We use a multidisciplinary care approach, which includes education and a stepwise approach to the management of AD similar to the approach to asthma. The National Asthma Education and Prevention Program: Expert Panel Report 3, like our AD program, includes instructions for daily treatment, ways to recognize and handle worsening disease, and emphasizes the use of a stepwise approach for this chronic disease using written action plans.[17]

This treatment model includes multiple educational strategies and requires that all members of the multidisciplinary team teach the same key concepts and reinforce the messages being delivered to the patients and caregivers regardless of which strategy is incorporated. Strategies include one-on-one communication, direct demonstration with reinforcement, group discussions, classroom teaching, and written materials, including an AD home care or AD action plan.

A critical educational strategy is direct demonstration of proper skin care, which includes topical application techniques and wet wrap therapy. Watching the patient's or caregiver's current technique often reveals fundamental errors that helps providers understand why a patient may not be responding to therapy as expected. The following are 2 illustrative examples of patients referred for treatment failure that improved with appropriate review of their application techniques and education. The first was a patient who failed hydration therapy, but observation revealed that a thick coat of petrolatum was applied before soaking her skin, rather than after the bath. The second patient was referred as a failure of topical corticosteroid therapy and was under using prescribed medicines demonstrated by both direct observation of application and by examining medicine tubes. A tube of medication, which should have lasted for 2 weeks, was still partly full after 3 months.

The patient or caregiver needs to understand details of the treatment regimen to ensure compliance and improved clinical outcomes. Many patients and caregivers misunderstand the potency of topical corticosteroids. This results in the application of a high-potency corticosteroid (eg, beclomethasone dipropionate 0.05%) to an area of the body such as the face or axillae while using a lower-potency corticosteroid (eg, hydrocortisone 2.5%) to the trunk or extremities, based on the patient's or caregiver's perception that corticosteroid potency is based solely on the assigned percent value (ie, 0.05% versus 2.5%), rather than on the specific corticosteroid preparation (ie, beclomethasone dipropionate versus hydrocortisone). This can be avoided through education, careful prescription writing and review on follow-up.

Patients may benefit from the teaching strategy of group or class instruction such as eczema school. The ADP includes a weekly 1-hour class in which dedicated and experienced registered nurses address the various aspects of AD. This class supplements teaching that occurs in the clinic, Day Program,

or inpatient settings. Contents of the slide lecture reflect input from the multidisciplinary team.

Just as asthma action plans are integral to the management of asthmatic patients,[17] so too AD Home Care Plans or AD Action Plans are integral to the management of the AD patient. Customized care plans are developed by the clinician, patient, and caregivers to meet the individual patient's and family's needs, and these plans are reviewed and modified at follow-up visits as the disease state changes.

Without such a written plan, patients or caregivers may forget or confuse skin care recommendations. Written home step-care plans have been provided for the twenty-year history of the program. Historically, these individualized teaching tools included a personalized booklet with annotated photographs, reflecting stages of disease and remission of each patient with detailed instructions for skin care. Current home care plans continue to be individualized, follow a standardized format and address treatment in a step-care manner (Fig. 1).

Offering patients accurate educational resources may prevent them from using less reliable ones. National organizations provide education and support for patients with AD. Educational brochures and videos can be obtained from the National Eczema Association (800-818-7546 or www.nationaleczema.org). Information, instruction sheets, and brochures, including a comprehensive Understanding Atopic Dermatitis booklet, are available from the National Jewish Medical and Research Center Lung Line (800 222-LUNG or www.njc.org). National Jewish also offers an on-line AD course for nurses as well as a video on wet wrap therapy.

Patients and caregivers are instructed to review advice or tips from friends, family, and other sources with their clinicians. Small changes to a treatment regimen can be detrimental, lack benefit, and add cost. Open and ongoing dialog between patients, caregivers and their clinician improves the likelihood of adherence with a treatment plan and may improve outcomes.

Medical Evaluation and Treatment

Patients with AD may seek many medical opinions when their prescribed regimen fails. They may be inaccurately labeled as a treatment failure as the result of a previous lack of evaluation of the whole picture. The majority of patients referred with a diagnosis of recalcitrant AD or treatment failure are helped with conventional therapy when thorough and appropriate attention is given to the individual patient (Figs. 2a and 2b, Table 1), including evaluation of triggers, skin care, and psychosocial aspects of disease.

Evaluation of Potential Triggers

Patients with chronic AD and their caregivers frequently search for the unique trigger whose avoidance will result in a cure. A key goal of the multidisciplinary approach to AD is to evaluate and educate these patients and caregivers about irritants versus allergens, as well as suspected versus proven triggers.

Irritants

Patients with AD have a lower threshold for irritant skin reactions, which may contribute to chronic inflammation.[18] Therefore, recognition and avoidance of irritants is emphasized in the ADP. Common irritants include soaps, detergents, solvents, acids, alkalis, particulate dusts, and "wet work." When irritants are identified as triggers, cotton gloves can be used as a barrier, allowing patients to maintain manual dexterity. Cotton gloves can decrease scratching trauma to the skin and are available in pediatric sizes.

Although soaps and detergents are potential irritants and are avoided by many patients, cleansers may be useful in patients with frequent skin infections.[19] Thus, the potential benefit of cleansers needs to be weighed against possible irritant effects.

Environmental factors such as temperature, humidity, and texture of fabrics can modulate the effect of irritants. An air-conditioned temperate environment with moderate humidity may minimize sweating and lessen skin irritation. Occlusive clothing should be avoided as loose-fitting, nonabrasive, and breathable cotton or cotton-blend garments may decrease overheating. Overheating and evaporation from intense sun exposure can contribute to skin irritation and disease flares. Although ultraviolet rays may have beneficial properties in AD, they also cause photodamage and sunburn. Education about the risks and benefits of natural sunlight and proper use of sunscreens is included in the program. Sunscreens formulated for sensitive skin or made specifically for the face are often best tolerated by AD patients.

Often, AD patients are counseled to avoid swimming in chemically treated pools, when such activity can in fact improve the dermatitis of some patients. After swimming, patients or caregivers are instructed to rinse using gentle cleansers followed by a moisturizer to effectively remove the chlorine or bromine.

Allergens

Patients are frequently referred to our ADP with a diagnosis of "AD due to multiple food allergies." Food allergens may play a role in a subset of patients with AD, particularly those younger than the age of 3 years.[20] Controlled food challenges were first reported at the authors' center in the 1970s, when it was recognized that a positive skin test to a food allergen did not necessarily define clinical relevance.[21] Removal of proven food allergens, however, from the patient's diet can lead to significant clinical improvement. Patients typically will have clinically relevant food allergy to only a small number of foods irrespective of the number of positive skin or in vitro tests. In children who have undergone double-blind, placebo-controlled food challenges, milk, egg, peanut, soy, wheat, and fish account for approximately 90% of the food allergens found to exacerbate AD.[20] Food challenges are usually performed after first clearing up the patient's eczema or achieving a stable baseline. The dietician plays a key role in evaluating patients' diets and educating patients and caregivers regarding appropriate diets.[22] Organizations such as Food

MAINTENANCE OR DAILY CARE

1. Take at least one bath or shower per day; use warm water, for 10-15 minutes.
2. Use a gentle cleansing bar or wash in the sensitive skin formulation as needed such as Dove® or Oil of Olay®.
3. Pat away excess water and immediately (within 3 minutes) apply moisturizer, sealer, or maintenance medication if directed. Fragrance-free moisturizers available in one pound jars include Aquaphor® Ointment, Eucerin® Crème, Vanicream®, CeraVe® Cream or Cetaphil® Cream. Vaseline® is a good occlusive preparation to seal in the water; however, it contains no water so it only works effectively after a bathing. Use moisturizers liberally throughout the day. Moisturizers and sealers should not be applied over any topical medication.
4. Avoid skin irritants and proven allergens.

MILD TO MODERATE ATOPIC DERMATITIS

1. Bathe as above for 10-15 minutes, once (and possibly twice) daily.
2. Use cleansers as above.
3. Use moisturizers as above to healed and unaffected skin, twice daily especially after baths and at mid-day total body.
4. Apply to affected areas of face, groin and underarms twice daily especially after baths _____(low potency topical corticosteroid), or_____ (topical calcineurin inhibitors), or other topical preparation as directed _____ (topical barrier repair cream, eg. Atopiclair® three times daily).
5. Apply to other affected areas of the body twice daily especially after baths _____(low to mid- potency topical corticosteroid), or _____(topical calcineurin inhibitors), or other topical preparation as directed _____ .
6. Add other medications as directed: _____(eg. oral sedating antihistamines, topical or oral antimicrobial therapy)
7. Pay close attention to things that seem to irritate the skin or make condition worse.

NOTES:

_____

_____

MODERATE TO SEVERE ATOPIC DERMATITIS

1. Bathe as above for 10-15 minutes, two times a day, once before bedtime.
2. Use cleansers as above or consider an antibacterial cleanser (eg. Lever 2000®)
3. Use moisturizers as above to healed and unaffected skin, twice daily especially after baths and at mid-day total body.
4. Apply to affected areas of face, groin and underarms twice daily especially after baths _____(low potency topical corticosteroid), or_____ (topical calcineurin inhibitors), or other topical preparation as directed _____ (topical barrier repair cream, eg. Atopiclair® three times daily).

Figure 1 National Jewish Atopic Dermatitis Program Action Plan.

Allergy and Anaphylaxis Network (www.foodallergy.org) can provide valuable information on hidden sources of common food allergens, recognizing specific food proteins by various names on food labels and methods of preparing foods with safe substitution of allergenic ingredients. Following the natural history of food-related AD is important because most patients will become tolerant to food allergens such as milk or egg protein, even in the face of positive skin tests. Quantifying specific IgE levels for food allergens measured by the Phadia ImmunoCAP assay can be helpful in determining when a food challenge or reintroduction of a food into a patient's diet would be appropriate.[20]

5. Apply to other affected areas of the body twice daily especially after baths _____(mid- to high- potency topical corticosteroid), or _____(topical calcineurin inhibitors), or other topical preparation as directed _____ .
6. Use wet wraps to involved areas selectively as directed.
7. Add other medications as directed: _____(eg. oral sedating antihistamines, topical or oral antimicrobial therapy)
8. Pay close attention to things that seem to irritate the skin or make condition worse.
9. Contact your health care provider for additional evaluation or therapies. Oral steroids are not usually recommended.
10. Step down to moderate plan above as the skin heals.

NOTES:

_____

_____

Reduce Skin Irritation.

1. Wash all new clothes before wearing them. This removes formaldehyde and other irritating chemicals.
2. Add a second rinse cycle to ensure removal of detergent. Residual laundry detergent, particularly perfume or dye, may be irritating when it remains in the clothing. Changing to a liquid and fragrance-free, dye-free detergent may be helpful.
3. Wear garments that allow air to pass freely to your skin. Open weave, loose-fitting, cotton-blend clothing may be most comfortable.
4. Work and sleep in comfortable surroundings with a fairly constant temperature and humidity level.
5. Keep fingernails very short and smooth to help prevent damage due to scratching.
6. Carry a small tube of moisturizer/sunscreen at all times. Daycare/school/work should have a separate supply of moisturizer.
7. Shower or bathe after swimming in chlorinated pool or using hot tub using a gentle cleanser to remove chemicals, then apply moisturizer.

Seek psychosocial support.

Use reliable resources for information on atopic dermatitis:

National Jewish Medical and Research Center
1400 Jackson Street
Denver, CO 80206
1.800.222.LUNG
www.nationaljewish.org

National Eczema Association
4460 Redwood Hwy. Ste. 16-
San Rafael, CA 94903
415.499.3474 / 800.818.7546
www.nationaleczema.org

Figure 1 (continued)

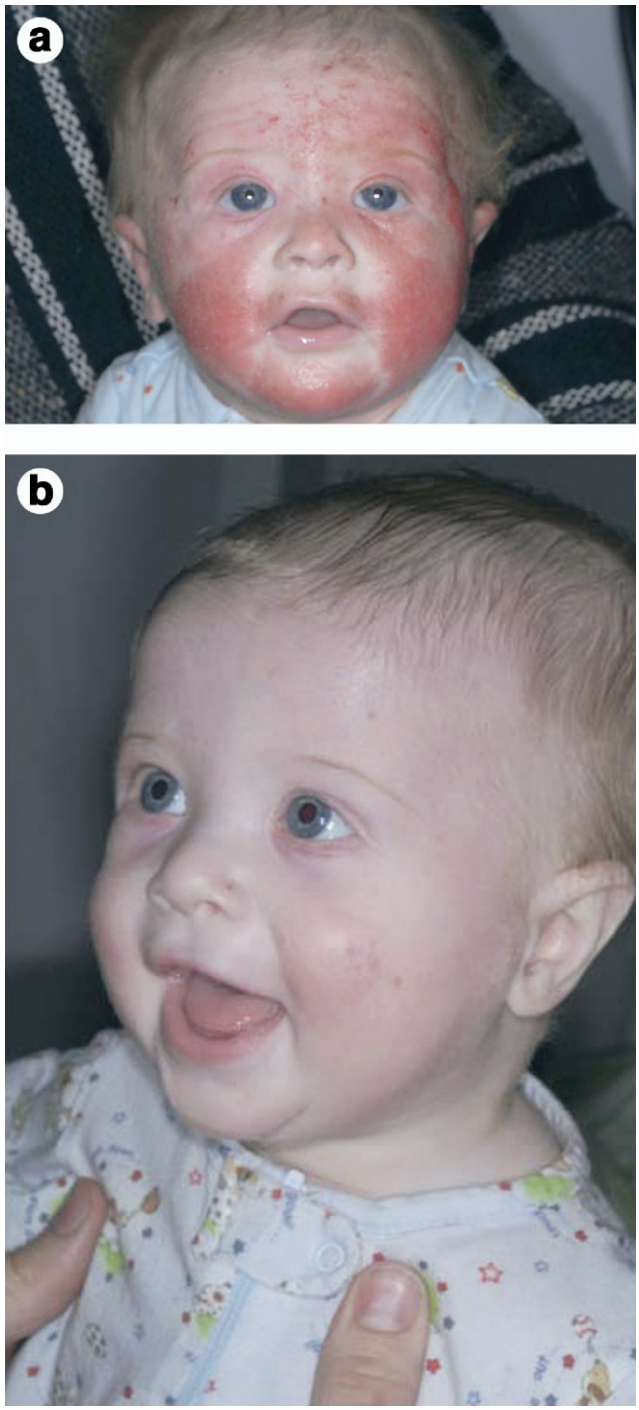

Figure 2 (a) Infant with severe atopic dermatitis. (b) Same infant after 1 week in the Day Program on wet wrap therapy.

Inhalant allergens such as dust mites may contribute to skin inflammation in AD for sensitized patients.[23] Importantly, environmental control measures aimed at reducing dust mite allergen load, including the use of dust mite-impermeable covers for pillows and mattresses, a simple and relatively low-cost environmental control measure, have been shown to improve AD in patients with specific IgE to dust mite allergen in controlled studies.[24,25] Although some studies have not found such benefit, this may reflect the need to reduce allergen exposure in other environments or other factors contributing to chronic skin inflammation.[26,27] Although no controlled studies have looked at avoidance of furred animals in homes of patients with AD, in allergic patients avoidance of such indoor allergens makes sense based on our current understanding of allergic inflammation.

Skin Care Evaluation and Treatment

Proper daily skin care remains a cornerstone of a successful treatment plan for AD. At the authors' center, "soak and seal" was developed as a fundamental concept to teach proper skin care emphasizing use of hydration, moisturizers, cleansers, and topical medications to help maintain an intact skin barrier.

Patients presenting to our ADP often are unclear about the role of skin care in management of AD. They frequently state that little time has been spent clarifying skin care instructions, with some avoiding hydrating their skin whereas others do it incorrectly. In addition, some clinicians have confused wetting of skin, which is typically followed by evaporation and microfissuring, with soaking of skin, which results in rehydration when done in conjunction with sealing in of moisture. Thus, water avoidance is often mistakenly recommended even for patients with significant xerosis. This may be an important reason that patients or caregivers report suboptimal response to a prescribed treatment regimen. Another important reason why bathing is avoided is that patients may complain of discomfort or pain when bathing (this also is true for various topical therapies) and thus this fundamental skin care measure is avoided, often resulting in progressive worsening of the AD. The following section will discuss some of the basic concepts or "pearls" that various members of our multidisciplinary team have found useful in promoting successful skin care strategies.

Our ADP teaches that proper bathing or soaking should be done at least once daily for approximately 10 to 15 minutes in warm water, with the patient making sure that involved areas are covered during the bath, to avoid evaporation. A wet washcloth or towel can be used to cover face, neck, or body not covered by water to ensure optimal hydration (Fig. 3). Showers may be appropriate in patients with mild disease. Conversely, baths can be increased to several times daily during flares of AD. Water temperature should feel comfortable to the patient, as the oft recommended "tepid" is usually too cool for most patients.

Additives to the bath remain at times unproven or controversial. The addition of oatmeal to the bath water may be soothing to patients, but it does not promote skin hydration, whereas bath oils may give the patient a false sense of lubrication and can make the tub slippery. The addition of bleach to bath water may be beneficial to patients with recurrent methicillin-resistant *Staphylococcus aureus* infections; however, the amount of bleach per volume of water and frequency of baths have not been well studied, and bleach baths may cause skin irritation. Bathing may also remove allergens from the skin surface and reduce general colonization by *Staphylococcus aureus*. Adding age-appropriate toys will help

Table 1 Practical Pearls for Managing AD

Spend time listening to the patient and/or caregiver
Explain the nature of the disease
Explain the role of proper skin hydration and all treatments
Demonstrate how to apply topical agents
Prescribe, as appropriate, topical corticosteroids and topical calcineurin inhibitors after taking into account: patient's age, site to be treated, extent/severity of disease
Prescribe, as appropriate, oral sedating antihistamines, topical and/or oral antimicrobials
Provide written recommendations regarding skin care including bathing and meds including prescription and over-the-counter products
Provide patient education brochures
Individualize treatment
Recommend environmental measures to avoid skin irritants and proven allergens
Recommend psychosocial support
Realize that deterioration in previously stable atopic dermatitis may result from: secondary bacterial or viral infection, development of contact allergy, poor understanding or adherence to recommended treatment
Review skin care and reinforce key messages at follow-up visits

young children cooperate with the bath. Of note, young children need to be supervised during baths.

Patients and caregivers need to be educated regarding proper use of cleansers. Cleansers with minimal defatting activity and a neutral pH are preferred. Formulations that are dye-free and fragrance-free are less irritating and more appropriate for atopic skin. We use sensitive skin formulations such as Dove®, and Oil of Olay® as well as others. Antibacterial cleansers may be helpful for patients with frequent folliculitis or recurrent skin infections. Patients should be instructed not to scrub with a washcloth while using cleansers.

After hydrating the skin, patients should gently pat away excess water with a soft towel and apply an occlusive preparation to prevent evaporation within 3 minutes (the "3-minute rule"). This concept has been promoted to patients by organizations such as the National Eczema Association (www.nationaleczema.org). Plastic spoons or wooden tongue depressors should be used to remove topical medications, especially ointments from jars to avoid contamination.[28] Moisturizers should be obtained in the largest-size available (typically 1 pound/480 g jars) because they typically need to be applied several times each day on a chronic basis. Recommended moisturizers that are available in a 1-pound jar include Aquaphor® Ointment, Vanicream®, CeraVe® Cream, Cetaphil® Cream, and Eucerin® Crème. Vegetable shortening (Crisco®) can be used as an inexpensive moisturizer. Patients and caregivers need to understand that petroleum jelly (Vaseline®) is a good occlusive preparation to seal in water; however, because it is a sealer, not moisturizer, it should be used after hydrating the skin. Of note, even young patients can be taught to apply their moisturizer, which allows them to participate in their skin care. Patients are instructed to apply moisturizers routinely but not over or immediately before topical medications to avoid dilution or blocking of penetration of medication into skin.

Figure 3 Bathing of child with AD with head involvement.

Patients and caregivers need to understand that frequent and proper use of moisturizers together with hydration may help re-establish and preserve the skin barrier.[29] Moisturizers can improve skin barrier function and reduce susceptibility to irritants.[30] Adding a moisturizer to a low potency topical corticosteroid has been shown to improve clinical parameters in patients with AD.[31] Moisturizers have also been shown to decrease the need for topical corticosteroids.[32]

A number of studies suggest that AD is associated with decreased levels of ceramides, contributing not only to a damaged permeability barrier, but also making the stratum corneum susceptible to colonization by *S. aureus*.[33] A ceramide-dominant emollient added to standard therapy in place of moisturizer in children with "stubborn-to-recalcitrant" AD resulted in clinical improvement.[34] Ceramide-containing creams marketed today as a barrier repair creams include Ceratopic®, TriCeram®, EpiCeram®, and CeraVe®. In addition, patients may be evaluated for benefit from other prescription nonsteroidal creams such as MAS063DP (Atopiclair®)[35] and S236 (Mimyx®) especially given concerns of some patients and caregivers regarding use of topical corticosteroids and calcineurin inhibitors.

Patients frequently do not understand how the various vehicles of skin care products such as ointments, creams, lotions, and oils can affect treatment outcomes. In general, ointments seal the best and can be the most hydrating when used after bathing and they are formulated with the fewest

additives. Because they are the most occlusive, in a hot, humid environment, they may trap perspiration, which may result in increased pruritus. Lotions and creams may be irritating due to added preservatives or fragrances. In addition, lotions contain more water than creams and may have a drying effect due to evaporation. Although oils may go on easily, they are often less effective moisturizers. Patients should be encouraged to carry moisturizers in small tubes with them at all times and to keep a separate supply in the daycare, school or work environment.

Wet Wrap Therapy

Wet wrap dressings have been used successfully in the management of recalcitrant AD in our program for more than 2 decades.[36] They reduce pruritus and inflammation by cooling of the skin and improve penetration of topical corticosteroids. They also act as a temporary protective barrier from the trauma associated with scratching. These actions can help the significant sleep disruption accompanying AD. Importantly, recent work has pointed to a beneficial effect of wet wrap therapy on the skin barrier with benefits continuing even after discontinuation of this treatment modality.[37] Of note, wet wrap therapy should be reserved for flares of AD and not used as routine maintenance therapy.

Although different variations of this treatment have been described, we use wet clothing, such as long underwear, turtle necks, pajamas, and cotton socks placed over an undiluted layer of topical corticosteroids applied after bathing followed by a dry layer of clothing, such as sweat suits or footed pajamas on top. At present, wet wrap therapy is not indicated over topical calcineurin inhibitors. Treatment of the head requires skilled nursing expertise with use of gauze bandages (Kerlix®) and surgical netting (Spandage®; Fig. 4).[36] It is important to emphasize that wet wrap therapy is not the wet-to-dry dressings used for debridement of wounds. Specifics of the procedure with detailed step-by-step photos have been previously described (Table 2).[38] A video is also available through National Jewish.

Wraps may be removed when they dry out (typically after 1-2 hours), or they may be re-wet. However, it is often practical to apply them at bedtime and most patients are able to sleep with them on. Patients occasionally will complain of feeling chilled, which can be prevented by appropriate bundling and use of warm blankets. Maceration of the skin and secondary infections are uncommon in the authors' experience, when wraps are applied properly. In fact, *S. aureus* colonization was found to be decreased in a controlled study of wet wrap dressings with topical corticosteroid.[39] This therapy is best reserved for acute exacerbations of AD (Fig. 2a), although it can also be used selectively to areas of resistant eczema especially of the hands and feet with minimal inconvenience. The extent and frequency of use should be reviewed regularly by the health care team, as benefits may be rapid and dramatic (Fig. 2b).

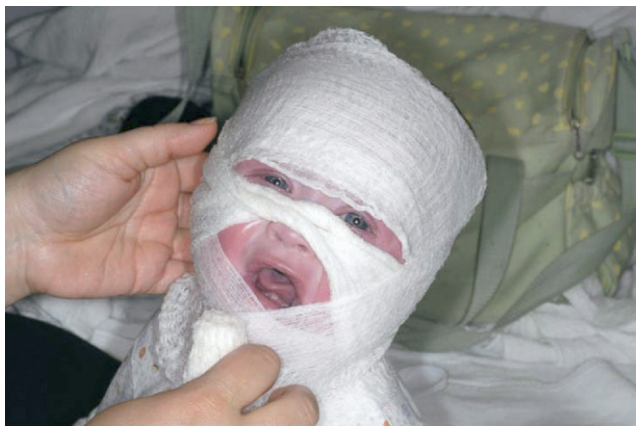

Figure 4 Wet wrap therapy of the face of an infant with severe facial eczema.

Pearls and Pitfalls of Medical Management

Topical Corticosteroids

Although topical corticosteroids have been the mainstay of treatment for AD, patients and caregivers continue to use them suboptimally or have concerns about their use.[40,41] A recent expert consensus from the Dermatology Working Group points out that "in an ideal world, dermatologists, dermatology nurses, . . . practitioners, . . . pharmacists would work together to advise and reinforce information about the correct way to apply topical corticosteroids, and to address concerns about the safety of these highly effective agents. But in the real world, expert advice, even when given, is soon forgotten . . . ."[42] Patients and caregivers need to have a basic understanding of topical corticosteroids, including that they are available in a range of potencies and vehicles with risks and benefits. Patients may erroneously assume that the potency of a topical corticosteroid is defined by the percent stated after the compound name (as discussed previously in the section "Education of Patients and Caregivers"). All too often, patients are prescribed a high-potency corticosteroid with instructions to discontinue it within 7 to 14 days, without a plan to step down, resulting in rebound flaring of their AD or recurrence of disease and associated frustration. A common teaching point is that use of a moisturizer or sealer immediately before, or over a topical corticosteroid may decrease the effectiveness of the latter.

Prescribing topical corticosteroids in inadequate amounts can also contribute to suboptimally controlled AD, especially in patients with widespread disease, given that it takes approximately 30 g of medication to cover the entire body of an average adult.[43] Patients who have to refill prescriptions frequently may under treat their eczema or become nonadherent with their prescribed regimen. In addition, obtaining medications in larger quantities can result in significant savings for patients.

Patients with AD often present to our ADP as "topical corticosteroid treatment failures." Reasons for this may include *S. aureus* superinfection, inadequate potency of the preparation, or an insufficient amount dispensed or applied. Other causes for apparent treatment failure include steroid

Table 2 Wet Wrap Therapy

Supplies:
1. Topical medications and moisturizers.
2. Tap water at comfortably warm temperature.
3. Basin for dampening of dressings.
4. Clean dressings of approximate size to cover involved area:
   a. ***Face:*** 2 to 3 layers of wet Kerlix® gauze held in place with SurgiNet®.
   b. ***Arms, Legs, Hands, and Feet:*** 2 to 3 layers of wet Kerlix® gauze held in place with Ace bandages or tube socks, or cotton gloves, or wet tube socks followed by dry tube socks. Tube socks may be used for wraps for hands and feet, and larger ones work as leg/arm covers.
   c. ***Total Body:*** Combination of above, or wet pajamas or long underwear and turtleneck shirts covered by dry pajamas or sweatsuit. Pajamas with feet work well for the outer layer.
5. Blankets to prevent chilling.
6. Nonsterile gloves if desired.

Procedure:
1. Be certain that the patient's room is warm and insure privacy. Gather supplies appropriate to the individual.
2. If wraps are to be applied to a large portion of the body, work with two people if possible. It is necessary to work rapidly to prevent chilling.
3. Explain the procedure to the patient and parent.
4. Fill the basin with warm tap water.
5. Usually, the patient will have had a soaking bath prior to this procedure or will soak the area in basin to be wrapped. Pat skin dry with a towel.
6. Apply the appropriate topical medications to affected areas and moisturizer to non-affected areas immediately after pat drying the skin. Use clean plastic spoons or tongue depressor to avoid contamination of products in jars. This allows large areas to be covered quickly and prevent caregivers from unnecessary exposure to topical medications.
7. Soak the dressings. Squeeze out excess water. Dressings should be wet, not dripping.
8. Cover an area with wet dressing chosen for the area and the patient. Immediately after wrapping, cover with appropriate dry material such as an Ace bandage, socks, or pajamas. Start at the feet and move upward. Use wet, long underwear or wet pajamas covered by dry pajamas or sweatsuit with total body involvement in place of wet gauze.
9. Take steps to avoid chilling. Blanket can be put in a dryer to warm up and cover patient, but do not overheat the patient. Wraps can be removed after 1 to 2 hours or can be re-wet. A warm blanket and snuggling help pass the time.
10. If patient is known or suspected to have an infection of the involved areas, place dressings in appropriate bag and dispose according to infection control procedure.
11. After all dressings are removed, moisturizers may be applied to the entire body.

allergy and possibly corticosteroid insensitivity. However, a much more common reason for therapeutic failure with topical corticosteroids is nonadherence to the treatment regimen. As with any chronic disease, patients or caregivers often expect a quick and permanent resolution of their illness and become disillusioned with the lack of a cure. A significant number of patients or caregivers admit to nonadherence with topical corticosteroids because of a fear of adverse effects.[40] In addition, patients often delay using their topical steroid after onset of a flare of their AD.[41] Thus, these factors need to be considered and addressed with the patient and caregiver when faced with a patient not responding to therapy.

Evaluating Side Effects of Chronic Oral Corticosteroid Therapy

Patients labeled as having oral steroid-dependent AD or treated with frequent or prolonged courses of systemic steroids need to be evaluated for corticosteroid side effects including adrenal suppression, osteoporosis, cataracts and muscle weakness and switched to other therapy. In our ADP, this includes measuring morning cortisol levels, bone densitometry, muscle strength and fitness level, calcium and vitamin D intake and ophthalmologic examination. Although patients are often referred for systemic therapy, proper education regarding fundamental skin care frequently allows them to discontinue systemic corticosteroids without need for other systemic immunomodulatory or immunosuppressive therapies.

Topical Calcineurin Inhibitors

Topical calcineurin inhibitors (TCIs), tacrolimus ointment (Protopic 0.03% and 0.1%) and pimecrolimus cream (Elidel 1%), represent an effective and safe nonsteroidal treatment for AD.[44] Nevertheless, patients and caregivers frequently misunderstand their place in the treatment algorithm. Common issues dealt with in our ADP include prescribing TCIs to replace topical corticosteroids when the patient is not doing well, often with unrealistic expectations for this class of drugs as to expected results or time to improvement. Patients and caregivers are also frequently not instructed about potential side effects, which often is the reason for drug being discontinued and patient labeled as TCI treatment failure. Application of TCIs from sample tubes during clinical encounters is a practical and valuable way of teaching patients and caregivers about these medications. In addition, this allows for risk-

benefit discussions, rather then allowing patients to get information when they fill prescriptions, which after the boxed warning, has resulted in unnecessary discontinuation of beneficial therapy by a number of patients and caregivers.[45] Of note, a Joint Task Force of the American College of Allergy, Asthma and Immunology and the American Academy of Allergy, Asthma and Immunology reviewed the available data and concluded that the risk/benefit ratios of tacrolimus ointment and pimecrolimus cream are similar to those of most conventional therapies for the treatment of chronic relapsing eczema.[46] In a recent case-control study of a large database that identified a cohort of 293,253 patients with AD, no increased risk of lymphoma was found with the use of TCIs.[47] In addition, long-term safety studies with TCIs in patients with AD including infants and children are ongoing.

Practical Aspects of Antiinfective Therapy

Patients referred to our ADP have frequently been treated with prolonged or repeated courses of antibiotics and increasingly are colonized by or infected with methicillin-resistant *S. aureus*. Patients become rapidly re-colonized after a course of antibiotics,[48] often with the same strains of toxin secreting *S. aureus*. A key goal in our ADP is to decrease use of systemic and topical antibiotics. Patients and caregivers are taught that the best defense against microbes is an intact skin barrier with fundamentals of skin care emphasized. In addition, patients are taught that antiinflammatory therapy decreases staphylococcal colonization.[49,50] Short courses of systemic antibiotics may be appropriate, but even our severe AD patients rarely require intravenous therapy. Treatment twice daily for 5 days with a nasal preparation of mupirocin may reduce nasal carriage of *S. aureus* and improve AD in some patients.[51] In addition, patients often self-medicate with topical neomycin on an as needed basis, resulting in allergic contact dermatitis that can be difficult to distinguish from underlying AD. Patients may also present with AD complicated by eczema herpeticum, which is underrecognized, especially when lesions become superinfected by *S. aureus*.[52] A subset of patients with AD colonized by *Malassezia sympodialis* may respond to treatment with antifungal agents.[7]

Practical Aspects of Antihistamine and Anxiolytic Therapy

Systemic antihistamines and anxiolytics have been helpful in managing patients with AD in our ADP primarily through their tranquilizing and sedative effects when needed. In general, second-generation antihistamines have been less useful in the treatment of AD, especially in controlling pruritus. However, they may still help with allergic triggers.

Other Treatments

During thorough review of patients' therapies in the ADP, we frequently discover that patients and caregivers are using a variety of over-the-counter, veterinary, and herbal products that they fail to report to their treating physicians. These may include topical antihistamines and local anesthetics that may cause local sensitization, as well as systemic herbal preparations that can cause severe idiosyncratic reactions. Asking the patient or caregiver to bring in any and all treatments has proven to be an extremely instructive process that provides practical insights regarding the what, when and where of skin care and often points to obvious reasons for treatment failure.

Psychosocial Evaluation and Treatment

AD has a negative impact on the QOL of both patients and their families.[53] Most distressing for children and their families is the intense pruritus, scratching, discomfort and disturbed sleep.[54] Treatment can be uncomfortable or even painful and children may resist treatment. Parents of children with AD report it can be frustrating to watch their child suffer, and to witness their child inappropriately treated by family, strangers, and other children.[53] Parents also report that children with AD can be irritable and difficult to discipline as they often scratch when upset. Thus, it is important to have a multidisciplinary team to help children and families learn to cope with their illness, regulate their sleep, change the itch-scratch-cycle and undergo treatment without further psychological trauma. Of note, increased behavior problems in young children with AD at age 35 months predicted subsequent onset of asthma by 53 months, even after controlling for IgE and severity of AD.[55] This study highlights another potential reason for effective treatment as it may change the future trajectory for these affected children.

The psychosocial component of the ADP team at our Center includes child life specialists, creative arts therapist, social workers, pediatric psychologists and child and adolescent psychiatrist. The child life specialists are often one of the first members of the multidisciplinary team to interact with the patient. They help patients cope with procedures by utilizing developmentally appropriate techniques to avoid or minimize psychological trauma. For example, the first few baths can be uncomfortable and anxiety provoking for children with severe AD, and the child life specialist use techniques such as distraction techniques with baths toys to minimize the child's distress.

On arrival each patient is assigned a psychosocial clinician to perform an assessment and tailor the intervention to the family and their needs, goals, and strengths. Intervention can range from brief psychoeducation and check-ins with the family as the patient undergoes treatment to daily therapy sessions focusing on such issues as parenting, relaxation techniques and other relevant issues. Minimizing scratching is often one of the treatment goals, but in severe cases of AD this is easier to achieve after the severe pruritus begins to abate with intense medical management. Techniques to minimize scratching vary by developmental age but include distraction, behavior replacement, cognitive therapy, biofeedback and hypnosis.[56]

In addition to individual care, children and their families also participate in daily group therapy. One session per week involves parents and children together, while other sessions generally involve children and parents in separate groups.

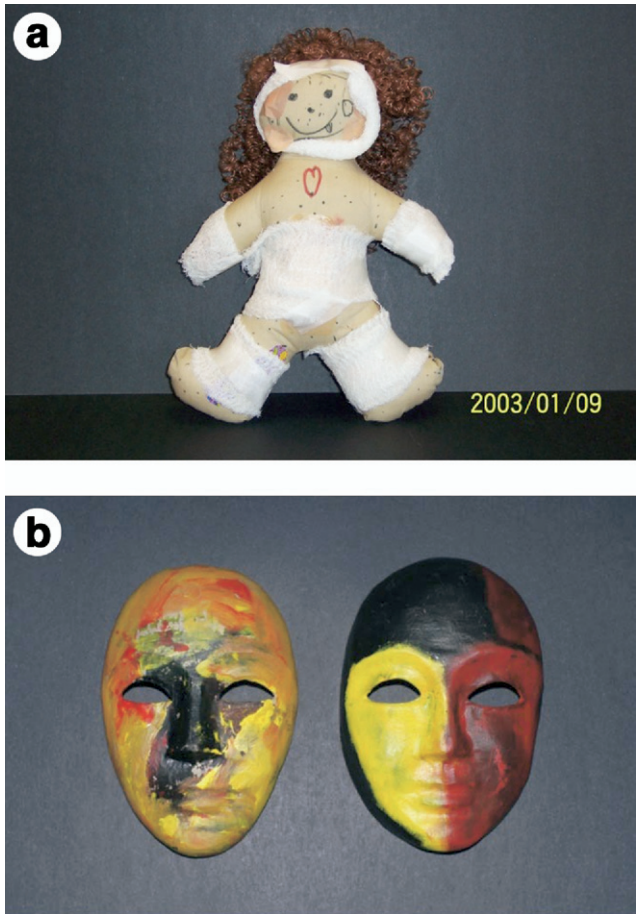

Figure 5 (a) Therapeutic doll decorated and cared for by a child during psychosocial evaluation and treatment of atopic dermatitis. (b) Masks painted by a patient with atopic dermatitis as part of psychosocial evaluation and treatment.

The children's group is led by the creative arts therapist and is focused on acclimatizing children to their treatment, helping them understand their feelings toward themselves and their illness and broadening their coping strategies. Importantly, children have the opportunity to meet peers who also suffer from a chronic illness which can help patients feel less isolated in their struggle with chronic illness. Creative arts techniques include having children with AD decorate and care for a doll with AD (Fig. 5a). In this technique the child is told that the doll has the same likes and dislikes as the child as well as the same medical problems. The child is asked to decorate the doll, mark areas of affected skin, care for the doll, help the doll feel safe, and help the doll's skin get better. In addition, the child gives the doll a symbolic bath and applies ointments and wraps.

Another technique used to help children understand their feelings toward themselves and their illness involves painting a mask early in the child's stay based on how they feel when their skin is not doing well and later painting a second mask as their AD improves (Fig. 5b). In the illustrative figure, in contrast to the mask on the left, the mask on the right reflects skin that is healing, but still has good days (yellow areas) and days where skin flares (red areas). Additionally, this patient reported that even though his skin felt better, he still had a hard time forgetting what it felt like to have bad skin (area of red on the top of head).

Parents also attend a daily group session and benefit from interacting with other parents experiencing similar challenges. The group meetings focus on parenting, coping with illness as a family, working with the medical team, and navigating activities outside the family.

Patients are referred to the Center's psychiatrist when the use of psychotropic medication is considered to treat symptoms of anxiety, depression, attention problems, irritability, and sleeplessness.[57] Many patients require medication to help them sleep for the first few nights, but often do not require this beyond 3 nights. It is our experience that the child's affect and behavior change remarkably with improvement of pruritus, discomfort, inflammation, and sleep and we therefore tend to schedule psychiatric consultations for mood and behavioral problems later in the ADP evaluation. Although the first bath can be frightening and uncomfortable, sedation is usually avoided as children generally rapidly acclimatize to this key therapy. We avoid using sedating medications such as benzodiazepines for the first bath for several reasons: first, the observed pattern of rapid acceptance of this intervention suggests that children are not too overwhelmed by their first bath. Second, by not prescribing sedating medications, the team avoids inadvertently giving the family the message that the child's behavior during the bath is so out of control that it requires psychotropic therapy. As the team is expecting the family to manage future baths at home during acute exacerbations, the approach is to use tools that will be available and appropriate for the family to use at home.

The entire multidisciplinary team holds weekly meetings to discuss each patient in the Day Program or the inpatient service, plan further care, and strategize around problems. This meeting effectively prevents miscommunication or splitting among team members, as it is critical for parents to hear a consistent message. In addition, the patient's family and the patient (if developmentally appropriate) attend a formal multidisciplinary meeting with the treating physicians and psychosocial clinician to help the family understand any tests or procedures, as well as ongoing treatment along with anticipated diagnostics and treatment and to plan for discharge, if appropriate. As described above, each patient is discharged with a written home-care plan detailing diagnoses, medications, treatments, as well as psychosocial recommendations with a plan for the school or day care if needed.

Parents of children with AD worry about their child's future. The ultimate goal of multidisciplinary care for children with AD is to give the family and child the skills and tools to control symptoms at home and improve the child's future QOL. A study of 50 children with AD treated through our ADP found that parents reported sustained improvements for their children in both symptoms of AD and QOL over the course of 2 years after treatment at our Center.[58]

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